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ABSTRACT

A growing body of empirical data suggests that there may be a true psychological distinction between academic and practical intelligence. If there is, then conventional ability tests used alone may reveal substantially less than we want to know about people's competence in everyday practical situations. Evidence to this effect is reviewed from mainstream U.S. culture and from Brazil, Morocco, Kenya, and Russia. A study of 261 Yup'ik Eskimo children in grades 9-12 assessed the importance of academic and practical intelligence in rural and urban Alaskan communities. Academic intelligence was measured with conventional measures of fluid and crystallized intelligence. Practical intelligence was measured with a homemade test of tacit knowledge relevant to the environment in which most Yup'ik people live. The test measured tacit knowledge in five content areas: herbs, fishing and fish preparation, survival, folklore, and hunting. Adults and peers rated the children in terms of being a good thinker who could survive and in terms of being a great hunter. Urban children generally outperformed rural children on a measure of crystallized intelligence, but the rural children performed better on the measure of Yup'ik tacit knowledge. The test of tacit knowledge was superior to the tests of academic intelligence in predicting practical skills of rural children. (Contains 54 references.) (Author/SV)

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The Relationship between Academic and Practical Intelligence:

A Case Study of the Tacit Knowledge of Native American Yup'ik People in Alaska

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Abstract

We assessed the importance of academic and practical intelligence in rural and urban Alaskan communities. A total of 261 children were rated for practical skills by adults or peers in the study: 69 in grade 9, 69 in grade 10, 45 in grade 11, and 37 in grade 12. Of these children, 145 were females and 116 were males, and they were from 7 different communities, 6 rural and 1 relatively urban. We measured academic intelligence with conventional measures of fluid and crystallized intelligence. We measured practical intelligence with a test of tacit knowledge as acquired in rural Alaskan Yup'ik communities. The urban children generally outperformed the rural children on a measure of crystallized intelligence, but the rural children generally outperformed the urban children on the measure of Yup'ik tacit knowledge. The test of tacit knowledge was superior to the tests of academic intelligence in predicting practical skills of the rural children (for whom the test was created), but not of the urban ones.

The Relationship between Academic and Practical Intelligence: A Case Study of the Tacit Knowledge of Native American Yup'ik People in Alaska

Although psychologists and laypeople often think of intelligence as a unitary entity, academic and practical aspects of intelligence may be somewhat distinct. One of the earliest psychologists to make this point was an experimental psychologist, Edward Thorndike (1924), who argued that social intelligence is distinct from the kind of intelligence measured by conventional intelligence tests. Many others subsequently have made this claim as well about social and practical intelligences (see reviews in Kihlstrom & Cantor, 2000; R. Wagner, 2000). A related claim was made by a well-known psychometrician, J. P. Guilford (1967), who separated behavioral content from more typical kinds of test-like content in his theory of the structure of intellect. More recently, Howard Gardner (1983, 1999) has argued that interpersonal and intrapersonal intelligences are distinct from the more academic ones (e.g., linguistic and logical-mathematical). Similarly, Salovey and Mayer (1990; Mayer, Caruso, & Salovey, 1999; Mayer, Salovey, & Caruso, 2000; see also Goleman, 1995) further have suggested the separateness of emotional intelligence.

Speaking generally, Neisser (1976) proposed that the conventional wisdom accurately reflects two different kinds of intelligence, academic and practical. Implicit theories of intelligence, in the United States (Sternberg, 1985b; Sternberg, Conway, Ketron, & Bernstein, 1981) and elsewhere (Grigorenko, Geissler, Prince, Okatcha, Nokes, Kenny, Bundy, & Sternberg, 2001; Sternberg & Kaufman, 1998; Yang & Sternberg, 1997), also suggest some separation of academic and practical aspects of intelligence.

The psychological theory underlying the present research makes a similar claim, namely, for a distinction between analytical intelligence (or what Neisser refers to as "academic intelligence") and practical intelligence (Sternberg, 1985a, 1988, 1997, 1999). According to Sternberg's triarchic theory of successful intelligence, the basic information-processing components underlying abstract analytical and practical intelligence are the same (e.g., defining problems, formulating strategies, inferring relations, and so on). But differences in tasks and situations requiring the two kinds of intelligence, and hence in the concrete contexts in which they are used, can render the correlations between scores on tests of the two kinds of intelligence positive, trivial or, in principle, negative. People who well apply a set of processes in one context may not be those who well apply them in another.

The issue in this article is not over whether analytical or academic intelligence matters at all. We believe there is solid evidence that the kind of analytical intelligence measured by conventional kinds of intelligence tests predicts performance, at least to some degree, in a variety of situations (see Barrett & Depinet, 1991; Carroll, 1993; Gottfredsen, 1996; Herrnstein & Murray, 1994; Hunter & Hunter, 1984; Jensen, 1998; Neisser et al., 1996; Schmidt & Hunter, 1981; Sternberg, Grigorenko, & Bundy, 2001; Wigdor & Garner, 1982; see also essays in Sternberg, 2000). Hence, we would not necessarily want to test for practical competence *rather than* for intelligence (McClelland, 1973), but instead for practical competence *in addition to* the particularly academic form of intelligence, because both might predict various kinds of performance relatively independently. Our argument in this article is that measures of both kinds of intelligence can be important in a variety of situations.

A growing body of empirical data suggests that there indeed may be a true psychological distinction between academic and practical intelligence. If there is, then conventional ability

tests standing alone may tell us substantially less than we ideally would want to know about people's competence in the practical situations they encounter in their daily lives. We review some of this evidence here, although more nearly complete reviews can be found in Sternberg, Forsythe, Hedlund, Horvath, Snook, Williams, R. Wagner, & Grigorenko (2000), Sternberg, R. Wagner, Williams, & Horvath (1995), and in R. Wagner (2000). First we review evidence from mainstream U.S. culture and then from countries more associated with the developing world.

In one study (Denney & Palmer, 1981), 84 adults between the ages of 20 and 79 were given two types of reasoning problems: a traditional cognitive measure, the Twenty Questions Task, where test-takers have to figure things out by posing artificial question of a kind not likely to be posed outside a game or at least a gamelike situation (e.g., "Is it living? Is it human?"); and a problem-solving task involving real-life situations such as: "If you were traveling by car and got stranded on an interstate highway during a blizzard, what would you do?" The most interesting result of this study for our present purpose was that performance on the traditional, academic, gamelike measure decreased linearly after age 20 whereas performance on the practical problem-solving task increased to a peak in the 40- and 50-year old age groups, and only then declined. Practical intelligence thus showed a developmental function over age more similar to crystallized than to fluid intelligence (Horn, 1994; Horn & Cattell, 1966). A similar result was found by Cornelius and Caspi (1987), who explicitly looked at measures of fluid, crystallized, and practical intelligence. The practical measures involved tasks such as dealing with a landlord who would not make repairs, getting a friend to visit one more often, and what to do when one has been passed over for promotion. Fluid abilities showed increases from about age 20 or 30 to age 50 and then declined. Crystallized and practical abilities increased until about age 70 before declining. However, the measures of practical abilities showed only modest

correlations with both the fluid and crystallized abilities measures, suggesting that the practical measures were assessing a distinct construct.

Sylvia Scribner (1984) investigated strategies used by milk-processing plant workers to fill orders. She found that rather than employing typical mathematical algorithms learned in the classroom, experienced assemblers used complex strategies for combining partially filled cases in a manner that minimized the number of moves required to complete an order. Although the assemblers were the least educated workers in the plant, they were able to calculate in their heads quantities expressed in different base number systems, and they routinely outperformed the more highly educated white-collar workers who substituted when assemblers were absent. The order-filling performance of the assemblers was unrelated to measures of school performance, including intelligence-test scores, arithmetic-test scores, and grades.

Another series of studies of everyday mathematics involved shoppers in California grocery stores who sought to buy at the cheapest cost when the same products were available in different-sized containers. These studies were performed before cost-per-unit quantity information was routinely posted. Lave, Murtaugh, and de la Roche (1984) found that effective shoppers used mental shortcuts to get an easily obtained answer accurate (although not always completely accurate) enough to determine which size to buy. But when these same individuals were given a mental-arithmetic test that required them to do much the same thing in a paper-and-pencil format, there was no relation between their ability to do the paper-and-pencil problems and their ability to pick the best values in the supermarket.

In our own research (reviewed in Sternberg, Forsythe, Hedlund, Horvath, Snook, Williams, R. Wagner, & Grigorenko, 2000; Sternberg, Wagner, & Okagaki, 1993; Sternberg, R. Wagner, Williams, & Horvath, 1995), we have investigated practical knowledge as it applies in a

variety of occupations, including management, sales, teaching, and military leadership. We have devised tests of an aspect of practical intelligence—tacit knowledge—which is what one needs to know to succeed in an environment that one is not explicitly taught and that usually is not even verbalized.

The term "tacit knowledge" has roots in works on the philosophy of science (Polanyi, 1966), ecological psychology (Neisser, 1976), and organizational behavior (Schön, 1983). The concept stems from the idea that much of the knowledge that is relevant to competent performance is not openly expressed or stated. Individuals often are not aware of the knowledge that underlies their action. Terms like *professional intuition* and *professional instinct* imply that some of the knowledge associated with successful performance has a tacit quality. Research on expert knowledge is consistent with this conceptualization. Experts draw on a well-developed repertoire of knowledge in responding to problems in their respective domains (Scribner, 1986). That knowledge tends to be procedural in nature and to operate outside of focal awareness (see Chi, Glaser, & Farr, 1988). It also reflects the structure of the situation more closely than it does the structure of formal, disciplinary knowledge (Groen & Patel, 1988).

We have tested tacit knowledge by constructing scenarios of the kinds people encounter in their daily lives in which the people face on-the-job problems that they need to solve. Participants in our studies then are typically presented with a variety of options for solving the problems. They are asked to rate the quality of each of the options, typically on a 1-9 scale. Responses are scored against those of experts. The closer the participant's profile is to the mean profile of the experts, the better the score on the test.

In a series of over a dozen studies extending over close to 15 years (Sternberg et al., 2000), we have made a number of observations. Most relevant here are the observations that (a)

practical intelligence measures tend to correlate significantly with each other; (b) they correlate variably with measures of academic intelligence—sometimes positively, often not at all, and sometimes negatively; (c) they tend to predict criteria of job success about as well as or at times even better than does IQ; and (d) they predict job performance significantly, even when variables including IQ, personality, and styles of thinking are placed first into a hierarchical regression model. For example, we have found that scores on a measure of tacit knowledge for military leadership predicted superiors' ratings of quality of leadership at three levels in the Army (platoon commander, company commander, and battalion commander), whereas IQ and even a measure of tacit knowledge for management did not. Thus, the kinds of tacit knowledge and skills relevant in various jobs complement the kinds of knowledge and skills measured by conventional tests of analytical abilities in predicting job performance.

The work described above all was done in developed countries. However, work in developing countries reveals similar findings. For example, Terezinha Nuñes and her colleagues (1994; Carraher, Carraher, & Schliemann, 1985) have studied the performance of Brazilian street children in mathematical reasoning tasks (see also Ceci, 1996; Ceci & Roazzi, 1994). She found, similarly to Lave and her colleagues, that the same children who were able to solve arithmetical problems in the setting where they actually needed to use these operations in their daily lives were often unable to solve comparable problems presented to them abstractly in paper-and-pencil format. Similarly, Robert Serpell (1976; see also Serpell, 1993) has found that how well children do in a toy-construction task depends upon the medium in which they are constructing the toys. Whether African or Western children do better depends on whether the medium is familiar to them or not. A similar finding emanates from the research of D. Wagner (1978), who

showed that whereas Western adults did better than Moroccan rug dealers on a fairly abstract memory test, the rug dealers did better on tests of their memory for patterns on Oriental rugs.

Sternberg, Nokes, Geissler, Prince, Okatcha, Bundy, and Grigorenko (2001) tested in a rural village in western Kenya the notion that academic and practical intelligence are separable and relatively distinct constructs. Eighty-five children (43 boys and 42 girls) between the ages of 12 and 15 years participated in the study. The main dependent variable of interest was their set of scores on a test of their tacit knowledge for natural herbal medicines used to fight illnesses. This kind of knowledge is viewed by the villagers as important in adaptation to their environment, which is understandable given that the overwhelming majority of the children have, at a given time, parasitic infections that can interfere with their daily functioning. They found that scores on the test of tacit knowledge correlated trivially or significantly negatively with measures of academic intelligence and achievement, even after controlling for socioeconomic status. They suggested that, among these villagers, time spent developing academic skills is likely to be perceived as taking away from time that needs to be spent developing practical skills, and vice versa. The result is that academic and practical intelligence can develop independently or even at odds with one another. Such a result is probably most likely in a society, such as that of rural Kenya, where implicit theories of intelligence depart greatly from Western explicit theories of intelligence. Indeed, Kenyan implicit theories of intelligence stress everyday skills far more than they stress academic ones (Grigorenko et al., 2001). Moreover, it has been shown that implicit theories of intelligence can affect the way people go about doing tasks in their academic as well as everyday lives (Dweck, 1999).

In another study, Grigorenko and Sternberg (2001) tested 511 Russian school children (ranging in age from 8 to 17 years) as well as 490 mothers and 328 fathers of these children.

They used entirely distinct measures of analytical, creative, and practical intelligence. We discuss here only the results for the analytical and practical aspects of intelligence. Consider, for example, the tests used for adults. Similar tests were used for children.

Fluid analytical intelligence was measured by two subtests of a test of nonverbal intelligence. The *Test of g: Culture Fair, Level II* (Cattell & Cattell, 1973) is a test of fluid intelligence designed to reduce, as much as possible, the influence of verbal comprehension, culture, and educational level, although no test eliminates such influences. In the first subtest we used, *Series*, individuals were presented with an incomplete, progressive series of figures. The participants' task was to select, from among the choices provided, the answer that best continued the series. In the *Matrices* subtest, the task was to complete the matrix presented at the left of each row.

The test of crystallized intelligence was adapted from existing traditional tests of analogies and synonyms/antonyms used in Russia. We used adaptations of Russian rather than American tests because the vocabulary used in Russia differs from that used in the USA. The first part of the test included 20 verbal analogies (KR20 = 0.83). An example is *circle—ball = square--? (a) quadrangular, (b) figure, (c) rectangular, (d) solid, (e) cube.* The second part included 30 pairs of words, and the participants' task was to specify whether the words in the pair were synonyms or antonyms (KR20 = 0.74). Examples are *latent--hidden,* and *systematic--chaotic.*

The measure of practical intelligence was self-report and also comprised two parts. The first part was designed as a 20-item, self-report instrument, assessing practical skills in the social domain (e.g., effective and successful communication with other people), in the family domain (e.g., how to fix household items, how to run the family budget), and in the domain of effective

resolution of sudden problems (e.g., organizing something that has become chaotic). For the subscales, internal-consistency estimates varied from 0.50 to 0.77. In this study, only the total practical intelligence self-report scale was used (Cronbach's alpha = .71). The second part had 4 vignettes, based on themes that appeared in popular Russian magazines in the context of discussion of adaptive skills in the current society. The four themes were, respectively, how to maintain the value of one's savings, what to do when one makes a purchase and discovers that the item one has purchased is broken, how to locate medical assistance in a time of need, and how to manage a salary bonus one has received for outstanding work. Each vignette was accompanied by five choices and participants had to select the best one. Obviously, there is no one "right" answer in this type of situation. Hence we used the most frequently chosen response as the keyed answer. To the extent that this response was suboptimal, this suboptimality would work against us in subsequent analyses relating scores on this test to other predictor and criterion measures.

In this study, exploratory principal-component analysis for both children and adults yielded very similar factor structures. Both varimax and oblimin rotations yielded clear-cut analytical and practical (as well as creative) factors for the tests. Thus, with a sample of a different nationality (Russian), a different set of tests, and a different method of analysis (exploratory rather than confirmatory analysis) again supported the notion of some kind of distinction between academic and practical intelligence.

The analytical and practical tests we employed were used to predict mental and physical health among the Russian adults. Mental health was measured by widely used paper-and-pencil tests of depression and anxiety and physical health was measured by self-report. The best predictor of mental and physical health was the practical-intelligence measure. Analytical

intelligence came second. Both contributed to prediction, however. Thus, Grigorenko and Sternberg (2001) again concluded that a theory of intelligence encompassing all three elements—with distinct analytical/academic and practical elements (as well as a distinct creative element) provides better prediction of success in life than does a theory comprising just the analytical element.

Any one or even subset of these findings might be criticized for one or another reason. But taken together, with their different strengths and weaknesses, the body of evidence suggests that the conventional wisdom that academic and practical intelligence are largely separate constructs may genuinely best represent the data that are currently available. If this is the case, then the general factor sometimes identified as central to intelligence needs to be viewed in a different way from the way it is conventionally viewed.

Claims of a general factor of intelligence, dating back to Spearman (1904) and continuing on to the present day (e.g., Carroll, 1993; Jensen, 1998; see essays in Sternberg & Grigorenko, in press) then take on a different cast. This cast is that the general factor, to the extent it exists, may characterize academic forms of intelligence quite well, but may not extend as well beyond them. Our goal is not to argue whether there "really" is a general factor in human intelligence, because from our point of view, the question easily degenerates into a semantic one. If one defines intelligence somewhat more narrowly (e.g., Jensen, 1998), a general factor seems to appear. If one defines intelligence somewhat more broadly (e.g., Gardner, 1983, 1999; Sternberg, 1985a), then it does not appear, or at least not with the full generality typically ascribed to it.

Our goal in the present study was to provide a further test of the hypothesis deriving from the triarchic theory of successful intelligence (Sternberg, 1985a, 1997; Sternberg et al., 2000) that academic and practical intelligence may be, from an individual-differences standpoint,

largely distinct constructs. We had previously shown such a distinction in a culture that is, from the standpoint of North America and Western Europe, rather exotic—that in rural Kenya. In this study, we have examined a culture that still is different, but that is not far removed from North American, precisely because it is in North America! This culture is that of the Native American Yup'ik peoples in relatively remote portions of Alaska. In such a culture, we would not expect results as dramatic as in rural Kenya (where negative correlations were obtained between some tests of academic intelligence and of practical intelligence). But we would still expect a separation between the academic and practical aspects of intelligence.

The term "Yup'ik" means "real person" in the Yup'ik language. This language is still spoken among many of the Yup'ik people. The Yup'ik Eskimos live primarily in the central and western portions of Alaska. They live mostly on flat, marshy, often frozen plains intersected by numerous bodies of water. Temperatures in the Yup'ik country range greatly, from as low as –80 degrees F. in the winter to as much as 80 degrees F. in the summer (Fineup-Riordan, 1990).

A wide variety of game and wildlife live in the areas populated by the Yup'ik. Due to both tradition and the reality (great distances between villages, relative isolation from the mainland of the United States ", and challenging weather conditions), hunting, fishing, and gathering remain important today, as they have for many years. Hence children are taught from an early age survival skills that long ago became largely irrelevant for most people living in North America and Europe. Those Yup'ik children who fail to learn these survival skills, fail at their own potential peril.

Social life among the Yup'ik people centers around the extended family and the community. Many Yup'ik live in small remote villages, where we have done most of the work described in this article (as well as other work; see Sternberg, Lipka, Newman, Wildfeuer, &

Grigorenko, 2002). These villages often today can be reached during winter from other parts of Alaska only by airplane, because they are separated from each other by vast, difficult-to-travel tundra. In the summer, ships can land. Snow-goes (snow mobiles) are also used to travel, although traveling between communities with snow-goes requires a great deal of knowledge about the terrain, as there are no marked roads and the intervening space is largely frozen tundra with what would appear to outsiders as having few landmarks. The communities often are situated by the water, making possible the traditional hunting, fishing, and gathering that still serve as the basis for subsistence. Many of the Yup'ik are relatively poor (because the main source of income often is through commercial fishing and hunting, both of which are season-dependent and vary greatly annually in yield), and governmental economic assistance is commonplace.

Village men and women teach survival skills as well as traditional crafts. Elders are relied upon for their wisdom, and elders from time to time speak at community centers to communicate this wisdom. Yup'ik children and teenagers can face the difficult challenge of trying to negotiate two worlds—the traditional world of the elders and the modern world of outside.

Method

Participants

There were a total of 261 children rated by adults or peers in the study: 69 in grade 9, 69 in grade 10, 45 in grade 11, and 37 in grade 12. Of these children, 145 were females and 116 were males. They were from 7 different communities: Akiachak (N = 27), Akiak (N = 21), Dillingham (N = 125), Manokotak (N = 17), New Stuyahok (N = 22), Togiak (N = 37), and Tuluksak (N = 12), Alaska. All of these communities are small rural, primarily Yup'ik villages,

except Dillingham, which is urban (by Alaskan standards), although not a major urban area (such as Anchorage, Fairbanks, or Juno). However, not all children who were rated (dependent variable) were available to be tested with the psychometric measures used in the study. For this reason, actual N's are given with each data analysis.

Materials

Independent variables. Independent variables were of two kinds—psychometric references tests and our own measure, the Yup'ik Tacit Knowledge Scale (YTKS).

1. *Test of "g": Culture Fair, Scale 2, Form A.* This test (R. B., Cattell & A. K. S. Cattell, 1960) measures fluid abilities and is often used as a test of g_f or of g, which are largely the same thing (Gustafsson, 1984). The test consists exclusively of geometric-reasoning items. It has four subtests: series completions (12 items), classifications (14 items), matrix completions (12 items), and topology (8 items).

2. *Mill Hill Vocabulary Scale—Junior Multiple Choice, U. S. Edition (1985 Revision), Forms A and B.* The test consists of 66 multiple-choice synonyms items (for the two forms combined).

3. *Yup'ik Tacit Knowledge Scale (YTKS).* This homemade test has 45 multiple-choice items. The test measures tacit knowledge relevant to adaptation in the primarily rural environment in which most of the Alaskan Yup'ik people live. The knowledge is "tacit" in the sense that it is procedural, not formally taught, and often not even verbalized. The test measures tacit knowledge in five different content areas: herbs, fishing and fish preparation, survival, folklore, and hunting. Tests of tacit knowledge can be more domain-general or more domain-specific, and more population-general or population-specific. This particular test was designed primarily to be domain-specific and population-specific.

The procedure for creating such a test is described in Sternberg et al. (2000). The test was created in collaboration between academics and local residents (including one of the coauthors of this article), based on extensive interviews. Because the test is unfamiliar, we present here example items from the test for each content area. An asterisk (*) indicates the correct response.

a. *Herbs*

Example 1. I can usually find the most *atsalugpiat* (cloudberries/salmonberries) in the:

(a) grass far from the water.

(b) hills that appear dry.

(c) hills that appear green.

(d) grass near a pond or marsh.*

b. *Fishing and Fish Preparation*

Example 2. Julie likes to make *sulunaqs* (salted fish heads) for her family. *Sulunaqs* are made from:

(a) trout.

(b) pike.

(c) king.*

(d) tomcod.

c. *Survival*

Example 3. When Eddie runs to collect the ptarmigan that he's just shot, he notices that its front pouch (balloon) is full of ptarmigan food. This is a sign that:

(a) there's a storm on the way.*

(b) winter is almost over.

(c) it's hard to find food this season.

(d) it hasn't snowed in a long time.

d. *Folklore*

Example 4. Lisa attends the Camai Festival every year to watch the Yup'ik dancers. She has noticed that some women dancers wear their *kameksaks* (boots) with long *alngaqs* (hanging leather straps), and some women have cut off their *alngaqs*. Lisa's grandmother says that according to the tradition, women cut their *alngaqs*:

(a) when they are engaged to be married.

(b) after they are married.*

(c) when they become pregnant.

(d) after giving birth for the first time.

e. *Hunting*

Example 5. Uncle Markus knows a lot about hunting wolverines. He is most likely to catch a wolverine when he sets his trap:

(a) on a slanted tree.*

(b) in the hollow of a dead tree.

(c) far from any water.

(d) near a frozen river.

Although the Yup'ik culture is very different from the Luo culture in Kenya, with which we have worked previously (Sternberg et al., 2001), one thing the cultures have in common is the use of natural herbal medicines to combat infections. Some of the items on our YTKS measured

knowledge of these natural herbal medicines and their uses (under the herbs) category. An example of such an item would be:

Example 7. *Naunerrluk* (stinkweed) is used to cure many ailments. Which of the following problems with *naunerrluk* NOT help you to cure:

(a) sore muscles.

(b) a cut on your hand.

(c) earache*.

(d) skin rashes.

Dependent variables. There were two major dependent variables pertaining to practical intellectual skills. The two principal questions asked of the villagers were:

1. Of the students on your list, who is the most *umyuartuli* (a good thinker, a risk taker who uses the mind to survive)?

2. Who is the most *bijuli* (a great hunter)?

These questions were asked both of adults (teachers and community leaders) and of peers of the children. The first question will be referred to as a measure of adaptive skills (AS), and the second as a measure of hunting skills (HS). Other questions were asked for purposes not relevant to this study. The methodology for collecting and analyzing these ratings was rather complex, because not all raters knew all children to be rated. This procedure is described fully in Grigorenko et al. (2001). In brief, all rated participants in the study were divided in overlapping triplets. Each triplet was rated by multiple raters, and the data were subjected to an analysis that produced an estimate of an ability of interest (e.g., *bijuli*) for each participant in the sample. The ratings of adults and peers were combined into one score by means of principal-components analysis.

Design

All participants received all measures. The design was thus fully within-subjects. However, not all raters rated all individuals (and, indeed, they could not because they were from different communities), so the ratings matrix was incomplete (see Grigorenko et al., 2001).

Procedure

Children were tested in schools or community centers in small groups. The tacit-knowledge measure was administered first, then the tests of fluid and crystallized abilities. Finally, children provided ratings. Adults who provided ratings did so at schools or community centers. All testing of children was done with parental informed consent as well as the children's assent.

Results

Basic Statistics

We were interested in the comparison between the urban community (Dillingham) and the rural communities (all the other locations).

We expected the urban students to outperform the rural ones on the conventional ability tests but the rural students to outperform the urban students on the YTKS. Our expectations were largely (although not totally) confirmed. The test of fluid intelligence (the Cattell) showed no significant difference between groups, although the urban students outperformed the rural ones (nonsignificantly). The relevant means were 28.48 (SD = 5.24, N = 123) for the rural group and 29.86 (SD = 7.61, N = 63) for the urban group. The test of crystallized intelligence did show a significant difference favoring the urban students, $t(187) = -6.10$, $p < .001$. The relevant means were 16.63 (SD = 3.70, N = 123) for the rural group and 20.16 (SD = 3.96, N = 66) for the urban group. The YTKS, on the other hand, showed a significant difference favoring the rural

students, $t(214) = 5.22$, $p < .001$. The relevant means were 19.53 (SD = 4.08, N = 131) for the rural communities and 16.20 (SD = 5.25, N = 85) for the urban community.

Reliabilities

Coefficient alpha (internal-consistency) reliabilities for our main measures were .81 for the Cattell, .92 for the Mill Hill (combined forms), and .65 for the YTKS. The YTKS measured very diverse elements of tacit knowledge across multiple domains (as described above), which is why its internal consistency would be expected to be, and was, lower. The Cattell was speeded, so its alpha internal-consistency reliability was somewhat suppressed. Split-halves reliability for this test (corrected by the Spearman-Brown formula) was .85.

Correlations

In general, we expected the YTKS to provide superior prediction in the rural communities relative to the urban community, because the test was created in rural communities and primarily oriented toward the activities of the rural communities. We also expected greater prediction for the hunting (HS) than for the adaptive (AS) dependent variable, because of the greater specificity of the hunting independent variable for the rural communities in which we created the test.

Between measures of fluid and crystallized abilities. Based on past research and conventional hierarchical models (e.g., Carroll, 1993), we predicted that the two conventional psychometric ability tests would show a significant correlation with each other, which they did. The correlation was .48 ($p < .001$, N = 175). The correlations were statistically significant as well in both the rural ($r = .51$, $p < .001$, N = 123) and urban ($r = .37$, $p < .01$, N = 52) communities.

Between the tacit-knowledge measure and measures of fluid and crystallized abilities. Based on our own past research (see, e.g., Sternberg et al., 2000), we predicted that correlations between our tacit-knowledge measure (the YTKS) and measures of fluid and crystallized abilities would be modest or nil. We were largely but not entirely correct in this prediction.

The correlation of the YTKS with the fluid measure (Cattell) was .05 (N = 174) overall, which was not significant. The correlation in the rural communities was .11 (N = 120) and in the urban community was .08 (N = 54). Neither of these correlations was significant. The correlation of the YTKS with the crystallized measure (Mill Hill) was .02 (N = 176) overall, which was not significant. In the rural communities, however, the correlation was .19 (N = 120, $p < .04$), which made significance. In the urban communities, the correlation of .14 (N = 56) was not significant.

Between the two ratings of practical skills. Recall that there were two relevant ratings of practical skills, which we shall refer to here as adaptive skills (AS) and hunting skills (HS). The correlation between these two ratings was .29 ($p < .01$, N = 89) overall. It was .32 in the rural communities ($p < .01$, N = 56) and a nonsignificant .08 in the urban community (N = 33). (Hunting skills included trapping skills, and hence were relevant to women, who do trapping commonly and often other types of hunting, as well as to men.) These results suggest that the two ratings are assessing related skills, but certainly not the same skills. The degree of overlap is probably higher in the rural communities, in which hunting is a much greater part of life than in the urban community.

Between conventional psychometric measures (fluid/crystallized) and ratings of practical skills. We expected modest but probably significant correlations between the conventional

psychometric measures and the ratings of adaptive skills, given that *g* predicts so many things (Jensen, 1998). The data were generally consistent with this prediction.

The overall correlation of the AS rating with the Cattell was .22 ($p < .01$, N = 174) and with the Mill Hill was .26 ($p < .001$, N = 157). The correlation for the Cattell in the rural communities was .21 ($p < .03$, N = 111) and in the urban community was .16, which was not significant (N = 43). The correlation for the Mill Hill in the rural communities was a marginally significant .19 ($p < .06$, N = 111) and in the urban communities was .32 ($p < .03$, N = 46).

The overall correlation of the HS rating with the Cattell was a nonsignificant -.14 (N = 72) and with the Mill Hill was a nonsignificant -.06 (N = 72). The correlations in the rural and urban communities all were also nonsignificant.

These results suggest that the conventional psychometric measures provide modest prediction of rated adaptive skills but do not predict rated hunting skills. Given the greater specialization of hunting skills, these results make sense.

Between the tacit knowledge measure (YTKS) and ratings of practical skills. The overall correlation of the AS rating with the YTKS was a nonsignificant .04 (N = 188). The correlation for the YTKS in the rural communities was .19 ($p < .04$, N = 117) and in the urban community was a nonsignificant -.08 (N =71). The overall correlation of the HS rating with the YTKS was .33 ($p < .01$, N = 87). The correlation for the YTKS in the rural communities was .38 ($p < .01$, N = 56) and in the urban community was a nonsignificant .16 (N = 31).

The results suggest that our tacit-knowledge measure (YTKS) provided modest prediction of adaptive skills in the rural community, but not in the urban community. The YTKS also provided moderate prediction of hunting skills in the rural communities. The YTKS was not

effective in the urban community, presumably because the tacit knowledge it measured was much more relevant to rural life than to urban life.

Multiple Regressions

We predicted each of the two dependent variables from the combined independent measures.

Overall, for the adaptive (AS) measure, the multiple R was .29 ($df = 3,145$; $p < .01$). The standardized regression weights (betas) for the three variables were .10 for the Cattell, .22 for the Mill Hill ($p < .02$), and .08 for the YTKS. For the hunting (HK) measure, the multiple R was .37 ($df = 3, 65$; $p < .02$. The standardized regression weights (betas) were -.12 for the Cattell, -.13 for the Mill Hill, and .35 ($p < .01$) for the YTKS.

For the adaptive (AS) measure, in the rural communities, the multiple R was .27 ($df = 3, 106$; $p < .04$). The standardized regression weights (betas) for the three variables were .15 for the Cattell, .06 for the Mill Hill, and .16 ($p < .10$) for the YTKS. For the urban community, the multiple R with the AK was .38 ($df = 3, 35$). Perhaps (at least in part) because of the small N, this value was not significant.

For the hunting (HK) measure, for the rural communities, the multiple R was .45 ($df = 3, 48$, $p < .02$). The standardized regression weights (betas) for the three variables were -.23 for the Cattell, -.02 for the Mill Hill, and .44 for the YTKS ($p < .01$). For the urban communities, the multiple R was .29 ($df = 3, 13$), which was not significant.

These results suggest that, on average, the YTKS provided prediction superior to that of the conventional psychometric measures in the rural but not the urban communities, as would be predicted. The superiority was especially apparent for the hunting dependent variable.

Discussion

We found that children in the urban community outperformed children in the rural community on the test of crystallized intelligence; children in the rural community, however, outperformed children in the urban community on the test of practical intelligence. We also found that a measure of practical intelligence assessing tacit knowledge provided prediction of rated practical skills that was complementary and, in certain instances, incremental to the prediction provided by conventional measures of fluid and crystallized intelligence. In the rural Yup'ik communities for which our test was created, it was the best measure of both adaptive and hunting skills. It provided lesser prediction in the urban community, as would be expected, given that members of the urban community engaged in the activities assessed by the test far less than did members of the rural communities.

In terms of theories of intelligence, our results suggest that tests of practical intelligence, in particular, as measured by tacit knowledge, can provide useful supplements to more conventional tests of more academic, analytical abilities (Neisser, 1976; Sternberg et al., 2000). In particular, analytical and practical intelligence may show quite distinctive patterns of individual as well as developmental differences (Carraher, Carraher, & Schliemann, 1985; Ceci & Roazzi, 1994; Cornelius & Caspi, 1987; Denney & Palmer, 1981; Lave, Murtaugh, & de la Roche, 1984; Scribner, 1994; Sternberg, 1997). An ideal assessment of intelligence thus would measure practical as well as academic analytical skills. The former kind of measure, of course, supplements rather than replaces the latter. According to the triarchic theory, intelligence overall involves a blend of both analytical and practical, as well as creative skills.

In terms of cultural settings, our results are largely consistent with the theories and data of Serpell (1976, 1993, 2000), Kearins (1981), the Laboratory of Comparative Human Cognition (1982) in suggesting that members of different cultures may more develop skills that are adaptive

in their own cultures and less develop skills that are adaptive in other cultures. Thus, it is possible to compare performances of members of different cultures only in a conditional way (Cole, 1996; Laboratory of Comparative Human Cognition, 1982), taking into account the kinds of behavior that are adaptive in a given cultural setting. And in making such comparisons, it is important to realize that what appears to be the same test may not be testing the same skills in different cultural settings (Greenfield, 1997).

One could argue, of course, that the kind of tacit knowledge we measured did not truly reflect practical intelligence or even intelligence at all. But in terms of the kinds of knowledge and skills considered adaptive in the culture we studies, we believe our measure was of intelligence in the sense in which the term most often has been used (Intelligence and its measurement, 1921; Sternberg & Detterman, 1986), namely, as a construct reflecting cultural adaptation. One further could argue that folk knowledge somehow should not "count." But it counts in the culture we studied and is the basis for everyday survival. And if intelligence is not about individual differences in everyday survival skills, what is it—or should it be—about?

Our results are largely consistent with a wide body of knowledge suggesting that measures of conventional IQ-like abilities tell a part, but not the whole story of a person's intelligence, broadly conceived. Our study is interesting, we believe, as a stand-alone demonstration of the importance of practical intelligence. But the study also joins a growing body of knowledge suggesting that practical intelligence can be and often is largely distinct from academic intelligence.

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